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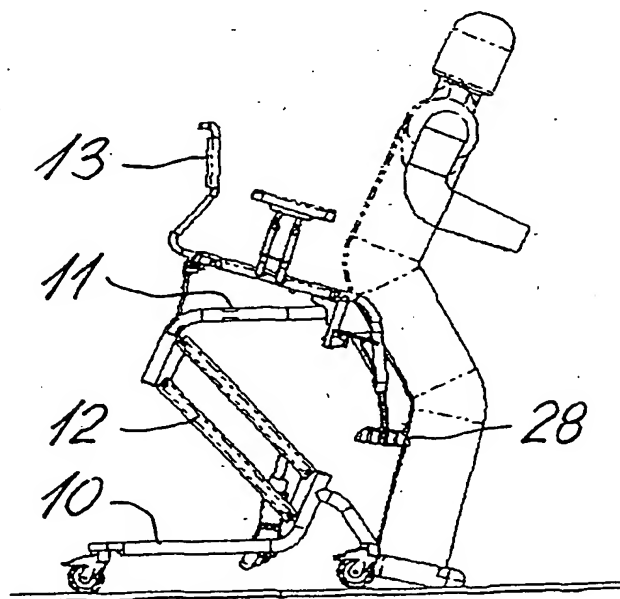
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(54) Title: A CHAIR FOR HANDICAPPED OR DISABLED PERSONS



(57) Abstract: A chair for handicapped and disabled persons comprises a frame (10), a seat (13), a lifting device (12), and means (29-31) for selectively tilting the seat in a forward direction. The seat is mounted on the frame by means of the lifting device (12), which is adapted to impart a combined upward and forward movement to the seat (13). Such chair may be used as a conventional commode or sanitation chair, and in addition the chair may be operated so as to assist the user in moving from a sitting to an upstanding position. When a person or user is sitting in the chair so that his or her feet are touching the ground the seat (13) may be lifted by means of the lifting device (12) so as to stretch the legs of the user, and at the same time the seat may be tilted forwards by operating the tilting means (29-31). This tilting movement of the seat combined with the forward movement of the seat caused by the lifting device pushes the posterior of the user forward, whereby the user is assisted in changing from a sitting to an up-right standing position. Conversely, a person may be assisted in changing from a standing into a sitting position by performing the operations described above in the reverse order.

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A chair for handicapped or disabled persons

- 5 The present invention relates to a chair for handicapped or disabled persons and of the type having a seat, which may be selectively raised and lowered to a desired level. A chair of this type may, for example, be used as a commode or as a sanitation chair. Such sanitation chair having a frame and a seat mounted thereon by means of a pair of parallel swing able arms is known. The seat may be raised and lowered by means of a pedal  
10 operated pump.

The present invention provides a chair of the above type, which may be used by a handicapped or disabled person with less assistance from a nurse or another assisting person.

15

- Thus, the present invention provides a chair for handicapped or disabled persons, said chair comprising a frame, a seat, a lifting device by means of which the seat is mounted on the frame, and which is adapted to impart a combined upward and forward movement to the seat, and means for selectively tilting the seat in a forward direction so as to allow a  
20 person sitting on the seat to move from a sitting to a standing position.

- Such chair may be used as a conventional commode or sanitation chair, and in addition the chair may be operated so as to assist the user in moving from a sitting to an upstanding position. When a person or user is sitting in the chair so that his or her feet are  
25 touching the ground the seat may be lifted by means of the lifting device so as to stretch the legs of the user, and at the same time operating the tilting means may tilt the seat forwards. This tilting movement of the seat combined with the forward movement of the seat caused by the lifting device pushes the posterior of the user forward, whereby the user is assisted in changing from a sitting to an upright standing position. Conversely, a  
30 person may be assisted in changing from a standing into a sitting position by performing the operations described above in the reverse order.

- The lifting device may be of any type adapted to move the seat upwardly with vertically upwardly as well as horizontally forwardly directed components of movement. As an  
35 example, co-operating tracks or cams and track or cam followers may determine the

movement. In the presently preferred embodiment, however, the lifting device comprises a parallelogram linkage movably connecting the seat to the frame and driving means for moving the seat in relation to the frame while maintaining the seat in a substantially horizontal position. The driving means may be operated by the user or by an assisting  
5 person.

The tilting means may comprise means connecting the seat to the lifting device so that the seat may be tilted about a horizontal axis, and biasing means which may be selectively activated so as to tilt the seat in a forward direction. This means that the seat is usually  
10 locked in a substantially horizontal position. However, when the seat is to be tilted forwards the locking means may be released so that the seat is biased towards the tilted position by the biasing means. The biasing means may comprise springs of any kind. Preferably, however, the biasing means comprises a gas cylinder. Alternatively, the tilting means may comprise a tilting device driven by an electric motor, which may be operated  
15 by the user or an assisting person.

The driving means for elevating and lowering the seat may be of any suitable type, such as hydraulically or pneumatically operated devices comprising hydraulic or pneumatic cylinders, respectively. Alternatively, the driving means may be of a mechanical type. In  
20 the latter case they preferably comprise a motor driven screw spindle and a co-operating nut member extending between the frame and the parallelogram linkage.

The seat may be a toilet seat so that the chair may be used as a commode chair. Furthermore, the chair may comprise a footrest, which is releasably mounted on the seat.  
25 The foot rest can then be removed when the chair is to be used for moving a person or patient from a sitting to an upright standing position or vice versa. To make the chair more comfortable and safe the seat may comprise a back and/or arm rests. These parts may be removable, if desired. Furthermore, in order to facilitate transportation of a person sitting in the chair the frame is preferably supported by wheels.

30

The present invention further provides a method for rising a handicapped person sitting in a chair of the type comprising a frame, a seat, a lifting device by means of which the seat is mounted on the frame, and which is adapted to impart a combined upward and forward movement to the seat, and means for selectively tilting the seat in a forward direction, to  
35 an upright standing position, said method comprising: placing the feet of the person in

contact with the floor or ground surface, lifting the seat by means of the lifting device to a position so as to stretch the legs while keeping the feet in contact with the floor surface, and tilting the seat forwards by operating the tilting means when lifting the seat so as to assist the person in straightening his body and so as to push the posterior of the person in  
5 a forward direction.

The invention will now be further described with reference to the drawings, wherein

- Fig. 1 is a rear bottom view of an embodiment of the chair according to the invention,  
10 Fig. 2 is a front and top perspective view of a chassis of the chair shown in Fig. 1,  
Fig. 3 is a side view of the chair chassis shown in Fig. 1,  
Fig. 4 is a diagrammatic illustration of the motion geometry the lifting mechanism of the chassis,  
Fig. 5 is a diagram, in which seat movements in vertical and horizontal directions are  
15 plotted as functions of the actuator length, and  
Figs. 6-9 illustrate how a handicapped person sitting on a chair according to the invention may be raised to a standing position.

Fig. 1 shows a chair according to the invention comprising a carriage frame 10, a chair  
20 support frame 11, a lifting mechanism 12 for lifting the support frame 11, and a seat part 13, which is fastened to the support frame 11. The carriage frame 10 is supported by at least three – in the present case four - castor wheels 14 enabling the chair to roll easily on a horizontal floor surface. For convenience the castor wheels 14 may be equipped with brakes of some kind.

25

As best shown in Figs. 2 and 3 the lifting mechanism 12 comprises two oppositely arranged pairs of mutually parallel lifting arms 15, which extend between the support frame 11 and the carriage frame 10, and which are pivotally connected thereto by pivots 16-19. The lifting mechanism further comprises an actuator 20, one end of which is  
30 fastened to a crossbeam 21 of the carriage frame 10 by means of a pivot bearing 22. The other end of the actuator 20 is pivotally connected to a crossbeam 23, which extends between the upper lifting arms 15 of said opposite pairs of arms. The actuator 20 is connected to the crossbeam 21 by means of a pivot 24. The pivots 16-19 of each pair of lifting arms define a parallelogram, so that the support frame 11 and the seat part 13  
35 mounted thereon is raised and lowered, when the actuator 20 is extended and retracted.

The actuator 20 may, for example, comprise an electric motor and by energising and reversing the motor the active length  $l$  (Figs. 2 and 4) may selectively be changed. When the length  $l$  of the actuator 20 is increased, the support frame 11 is lifted or moved  
5 upwards and forwards along an arc of a circle without tilting in relation to the carriage frame 10.

The seat part 13 comprises a seat 25, for example a toilet seat, which may be covered by a cover seat (not shown), a pair of removable armrests 26, a back support 27, and a  
10 removable footrest 28 (Figs. 6-9). The seat part 13 is tilt ably mounted on the support frame 11 by means a bearing or pivot pin or shaft 29 formed on the crossbar or crossbeam 23 and defining a substantially horizontal tilting axis.

A tubular bearing bushing 30 formed at the front end of the seat part 13 engages with the  
15 pivot shaft or pin 29, whereby the seat part 13 is connected to the support frame 11 such that the seat part can tilt forwards and backwards relative to the support frame. The opposite ends of an actuator device 31 are pivotally mounted to the rear end of the seat 25 and to the support frame 11, respectively, for example at one of the pivots 19.

20 When activated, the actuator device 31 may control the tilt of the seat part 13 relative to the support frame 11. The actuator device 31 may either be of an active, motorised type or of a passive spring type, such as a coil spring or a gas spring, with or without a locking mechanism.

25 Fig. 4 illustrates very simplified the geometry of the lifting mechanism 12. In Fig. 4 the length of the lifting arms 15 is  $b$ , the distance between the pivots 16 and 24 is  $c$ , the horizontal and vertical distances between the pivots 16 and 22 are  $d$  and  $f$ , respectively, the vertical height of the pivot bearing above floor level is  $e$ , the horizontal and vertical components of the arm 15 are  $j$  and  $k$ , respectively,  $h$  is the vertical height of the pivot  
30 29,30 above the pivot 17, and  $i$  and  $s$  are the horizontal and vertical component, respectively, of the distance between the pivot 29,30 and the front edge  $E$  of the seat 25. A line through the pivots 16 and 22 defines an angle  $D$  with vertical, and  $L$  is an angle defined between said line and the lifting arm 15. Some of the above designations are also shown in Figs. 2 and 3.

The co-ordinates x and y of the edge E in the x-y co-ordinate system indicated in Fig. 4 may now be calculated by the following equations:

$$D = \arctan(d/f)$$

$$L(l) = \arccos \left[ \frac{(c^2 + d^2 + f^2 - l^2)}{2c\sqrt{f^2 + d^2}} \right]$$

$$Y(l) = e + f + h + s - b \cos(D + L(l))$$

$$X(l) = g + i - b \sin(D + L(l))$$

As an example, the constant values may be as follows:

$$\begin{aligned} b &= 525 \text{ mm} & d &= 130.92 \text{ mm} & f &= 268.75 \text{ mm} & h &= 120.93 \text{ mm} \\ 20 \quad s &= 44 \text{ mm} & c &= 100 \text{ mm} & e &= 97.85 \text{ mm} & g &= 388.22 \text{ mm} \\ i &= 150 \text{ mm} \end{aligned}$$

with the actuator length  $l$  varying over the range 270 mm to 350 mm.

25 Based on the above values and by means of the above equations the co-ordinates of the front seat edge E have been calculated for various lengths  $l$  of the actuator 20 and plotted in the diagram shown in Fig. 5. In Fig. 5 the horizontal and vertical movements of the front seat edge E are plotted as functions of the length  $l$  of the actuator 20. Thus, the upper solid curve illustrates the vertical movement of the front seat edge E, while the lower dotted curve illustrates the horizontal movement of the edge E in response to the varying

30 length  $l$  of the actuator 20.

A person who is in need of care and is seated in a chair according to the invention as described above may be elevated or lowered to a suitable working position for the carer by operating the actuator 20, for example by means of a remote control, not shown.

During such lifting or lowering operation the seat part 13 may be kept in a slightly  
5 backwards-tilted position or any other position, which is comfortable for the user and the carer. For example, when used over a toilet the height of the chair according to the invention may readily be adjusted as needed. The chair meets all the normal applications of a commode chair with detachable armrests etc for shifting a disabled person in or out of the chair.

10

Figs. 6-9 illustrate how the chair according to the invention may also be used for assisting a person who is able to stand on his feet and walk, maybe with support, but who has difficulties in rising onto his feet from a seated position. As a first step the footrest 28 is removed, the wheels 14 are locked, and the actuator 20 is operated so as to lower the

15 seat 25 until the feet of the sitting person make contact with the floor.

Now, as illustrated in Figs. 7-9, extending the actuator 25 elevates the seat 25 and at the same time the actuator device 31 is operated (by a carer or by the patient) so that the seat part 13 begins to tilt forward. Thereby the person is assisted in stretching his legs towards an upright, standing position while he is still leaning back against the seat part 13  
20 so that he has a comfortable feeling of safety. When the legs of the patient or person are fully or nearly fully stretched the seat is moved forwards through the last part of the circular movement of the support frame 11 and the seat part mounted thereon. Finally, the person has been raised to and is left in a balanced, upright position. It should be understood that the seat movement thus used for rising a person from a sitting to a  
25 standing position is a combination of the upward and forward movement of the seat part 13 caused by the lifting mechanism 12 and the forward tilting of the seat part caused by the actuator device 31. A standing person may be transferred to a sitting position in the chair by performing the above steps in a reverse order.

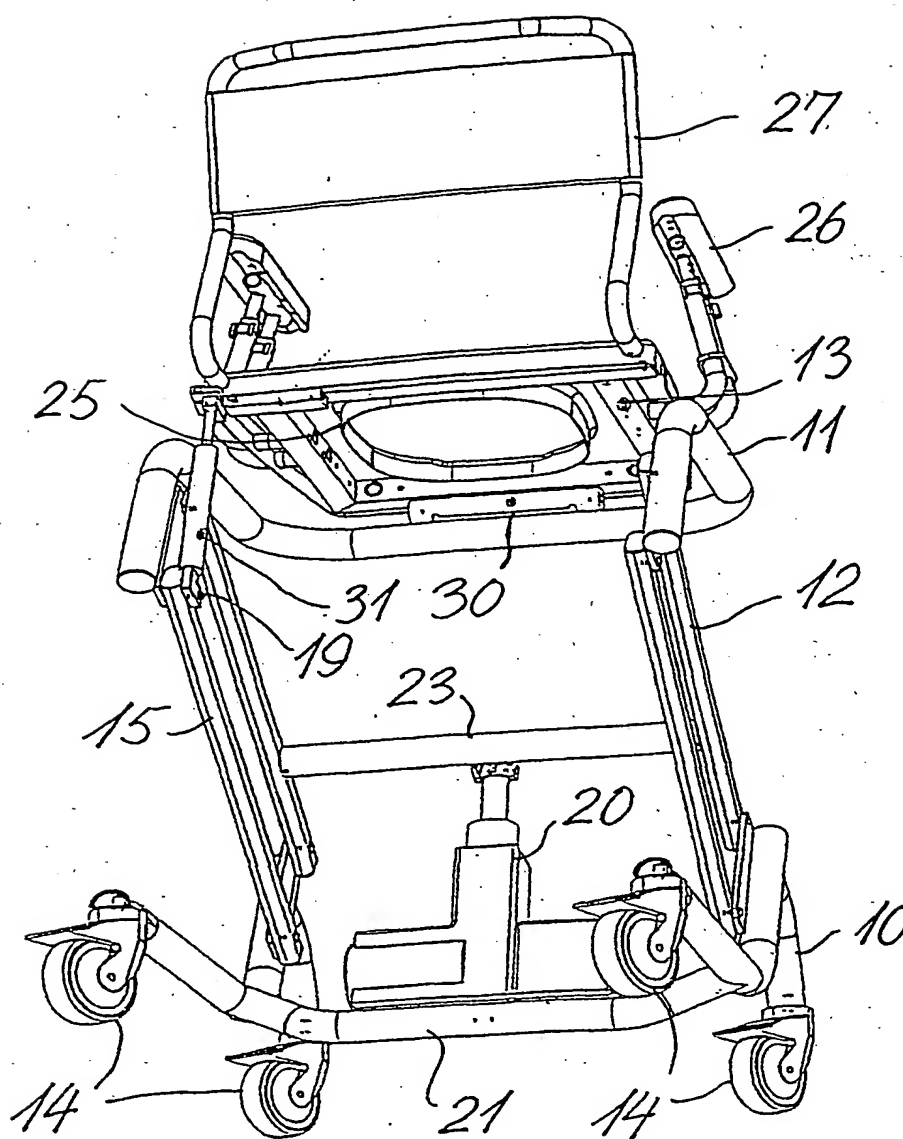
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## CLAIMS

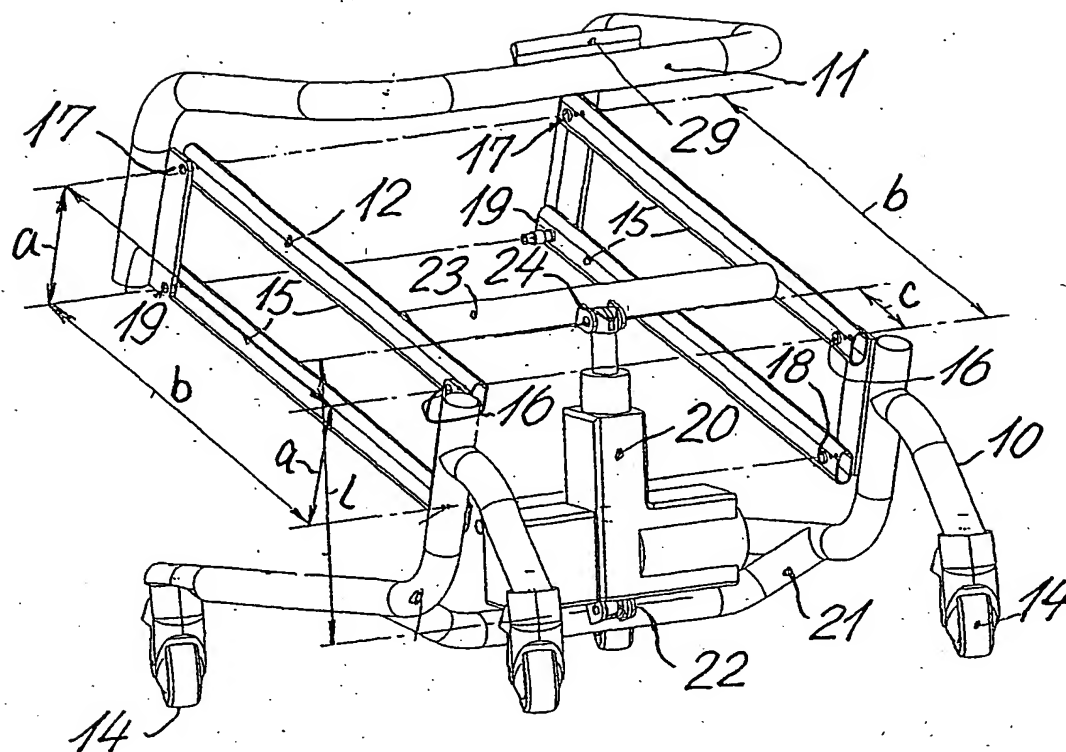
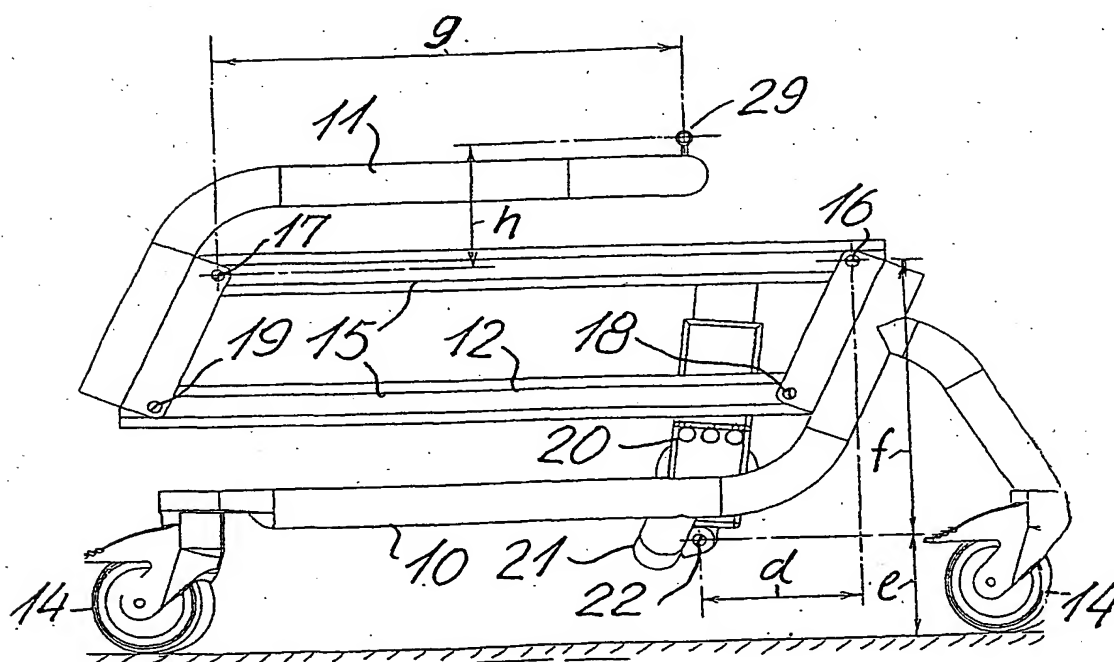
1. A chair for handicapped and disabled persons, said chair comprising a frame (10), a seat (13), a lifting device (12) by means of which the seat is mounted on the frame, and  
5 which is adapted to impart a combined upward and forward movement to the seat, and means (29-31) for selectively tilting the seat in a forward direction so as to allow a person sitting on the seat to move from a sitting to a standing position.
2. A chair according to claim 1, wherein the lifting device comprises a parallelogram  
10 linkage (15-19) movably connecting the seat (13) to the frame (10) and driving means (20) for moving the seat in relation to the frame while maintaining the seat in a substantially horizontal position.
3. A chair according to claim 1 or 2, wherein the tilting means comprises means (29,30)  
15 connecting the seat (13) to the lifting device (12) so that the seat may be tilted about a horizontal axis, and biasing means (31), which may be selectively activated so as to tilt the seat in a forward direction.
4. A chair according to claim 3, wherein the biasing means (31) comprises a gas cylinder.  
20
5. A chair according to any of the claims 2-4, wherein the driving means (20) comprises a motor driven screw spindle and a co-operating nut member extending between the frame (10) and the parallelogram linkage (15-19).
- 25 6. A chair according to any of the claims 1-5, wherein the seat (13) comprises a toilet seat (25).
7. A chair according to any of the claims 1-6, further comprising a footrest (28) releasably mounted on the seat (13).
- 30 8. A chair according to any of the claims 1-7, wherein the seat (13) comprises back and/or arm rests (26,27).
9. A chair according to any of the claims 1-8, wherein the frame or chassis (13) is  
35 supported by wheels (14).



10. A chair according to any of the claims 1-9, wherein the wheels (14) supporting the frame or chassis (13) are motor driven and/or actively steered, jointly or individually.
- 5 11. A method for rising a handicapped person sitting in a chair of the type comprising a frame (10), a seat (13), a lifting device (12) by means of which the seat is mounted on the frame, and which is adapted to impart a combined upward and forward movement to the seat, and means (29-31) for selectively tilting the seat in a forward direction, to an upright standing position, said method comprising:
- 10       placing the feet of the person in contact with the floor or ground surface,  
          lifting the seat by means of the lifting device (12) to a position so as to stretch the legs while keeping the feet in contact with the floor surface, and  
          tilting the seat forwards by operating the tilting means (29-31) when lifting the seat so as to assist the person in straightening his body and so as to push the posterior of the  
15 person in a forward direction.

**Fig. 1**

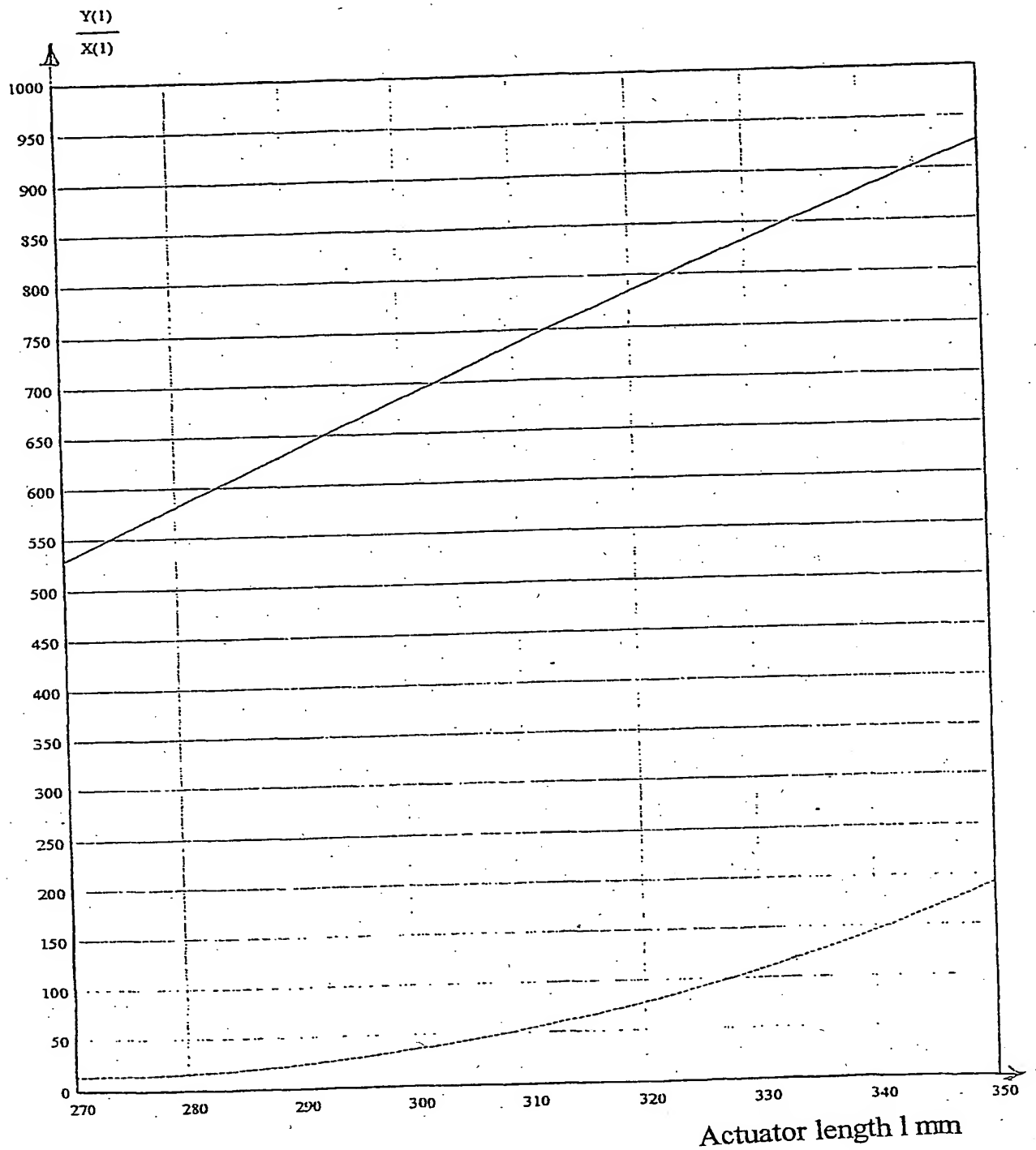
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**Fig. 2****Fig. 3**

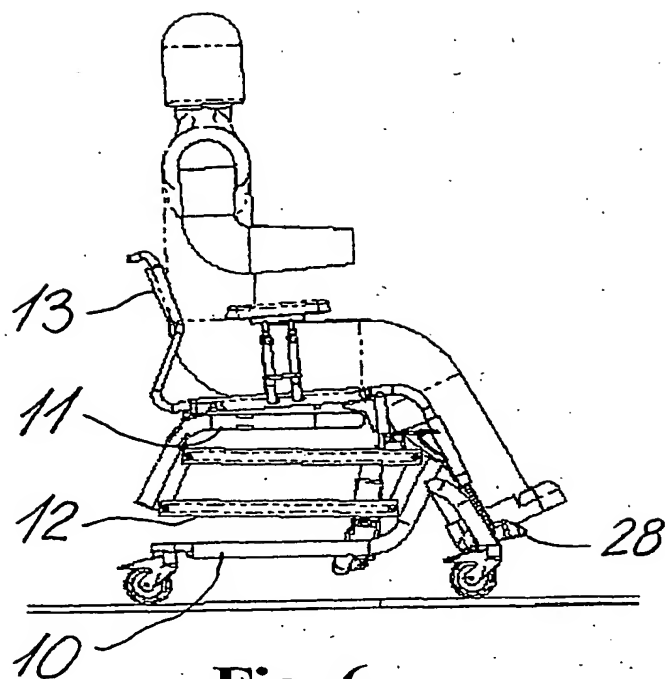
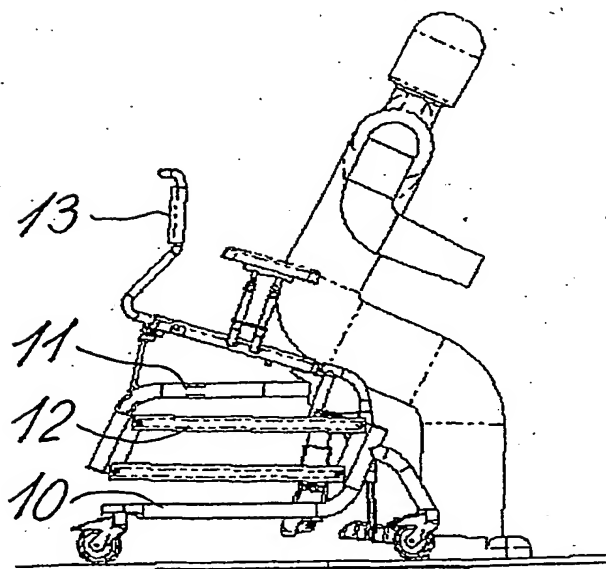


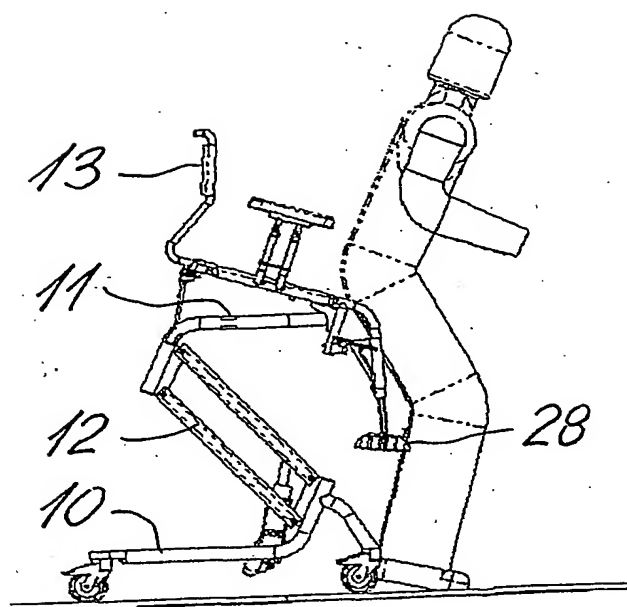
Seat front movement

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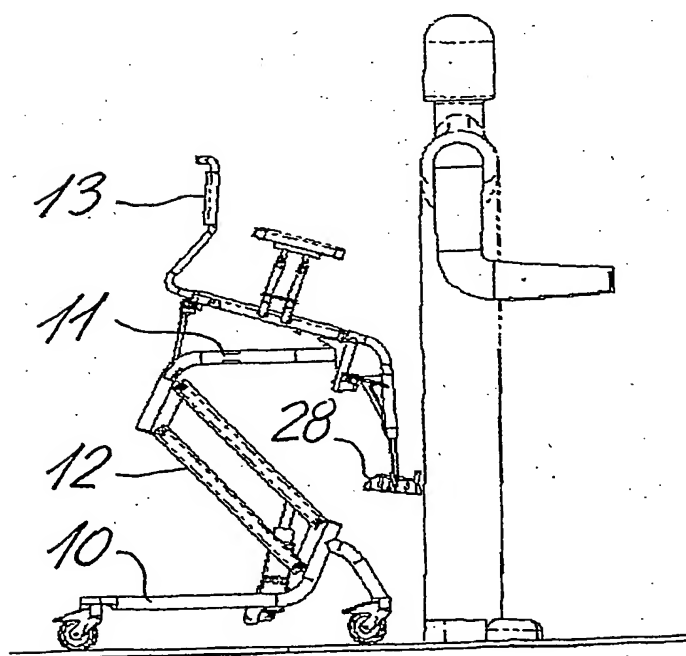
**Fig. 5**

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**Fig. 6****Fig. 7**



**Fig. 8**



**Fig. 9**

## INTERNATIONAL SEARCH REPORT

International Application No

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A. CLASSIFICATION OF SUBJECT MATTER  
IPC 7 A61G5/14 A61G5/10

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 A61G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EP0-Internal

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

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International Application No

PCT/DK 01/00338

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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